FIG. 1

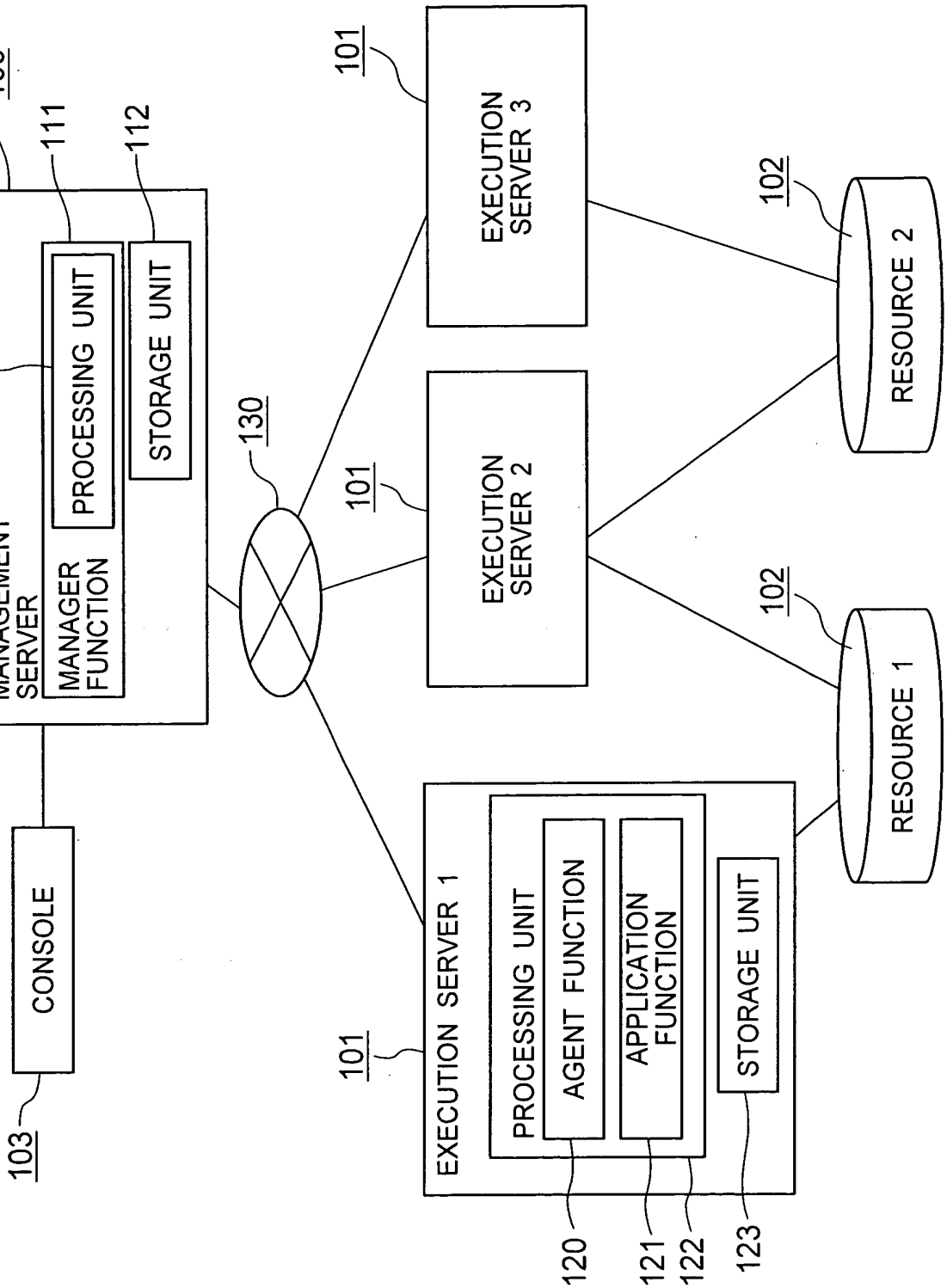
100
111
112
110
MANAGEMENT SERVER
MANAGER FUNCTION
PROCESSING UNIT
STORAGE UNIT
CONSOLE
103
130
101
EXECUTION SERVER 3
EXECUTION SERVER 2
EXECUTION SERVER 1
PROCESSING UNIT
AGENT FUNCTION
APPLICATION FUNCTION
STORAGE UNIT
120
121
122
123
102
RESOURCE 2
RESOURCE 1

FIG. 2

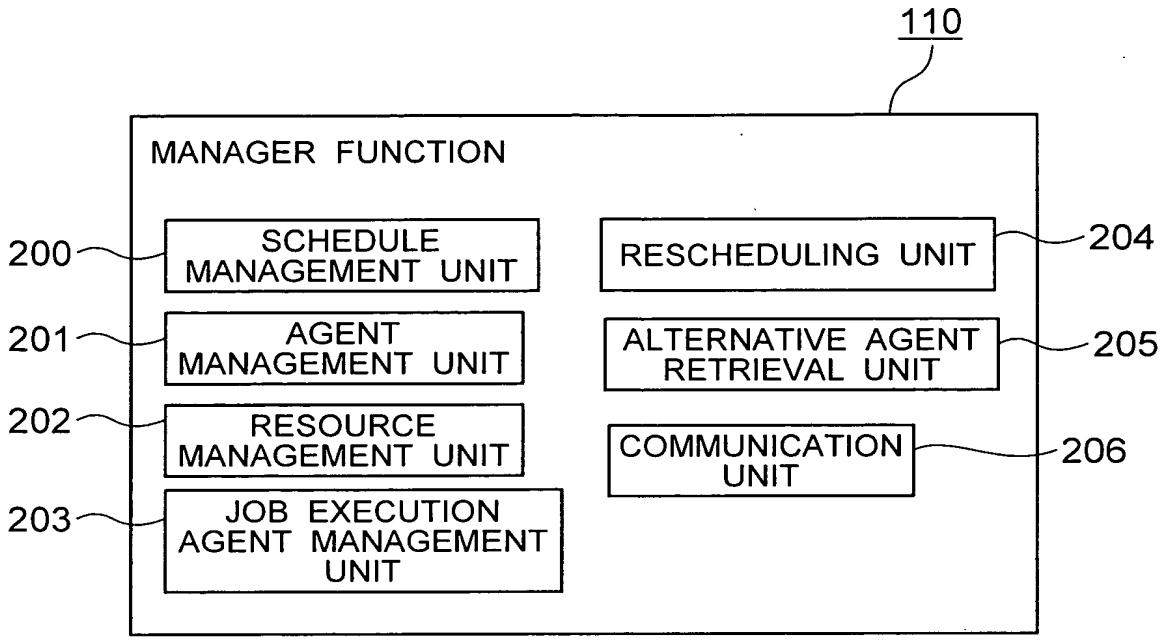

FIG. 3

SCHEDULE TABLE 300

301 EXECUTION START DATE AND TIME	302 FINAL END DATE AND TIME	303 MAXIMUM EXECUTION TIME	304 EXECUTION AGENT	305 EXECUTION JOB
2002/11/10 10:00:00	2002/11/10 10:00:00	01:00	AGENT 1	JOB 1
2002/11/10 23:00:00	2002/11/11 00:00:00	00:30	AGENT 2	JOB 2
WEDNESDAYS 12:00:00	.	02:00	AGENT 3	JOB 3
. . .	. . .	. . .	. . .	. . .

FIG. 4

JOB TABLE 400

401 JOB NAME	402 CONTENT OF EXECUTION	403 EXECUTION RESOURCE	404 MAXIMUM PERMISSIBLE COST	405 PRIORITY
JOB 1	CALCULATING PROCESS	CPU, MEMORY	10	A
JOB 2	BATCH PROCESS	CPU, MEMORY, DISK	20	B
JOB 3	DATABASE PROCESS	CPU, MEMORY, DATABASE APPLICATION PROGRAM, RESOURCE 2	70	A
JOB 4	DATABASE PROCESS	CPU, MEMORY, DATABASE APPLICATION PROGRAM, RESOURCE 1	30	C
⋮	⋮	⋮	⋮	⋮

FIG. 5

AGENT MANAGEMENT TABLE 500

501 AGENT NAME	502 EXECUTION SERVER
AGENT 1	EXECUTION SERVER 1
AGENT 2	EXECUTION SERVER 2
AGENT 3	EXECUTION SERVER 3
AGENT 4	EXECUTION SERVER 2
. . .	. . .

FIG. 6

INTER-RESOURCE DISTANCE MANAGEMENT TABLE 600

602

601		603	USING EXECUTION SERVER			
			EXECUTION SERVER 1	EXECUTION SERVER 2	EXECUTION SERVER 3	...
AVAILABLE RESOURCES	EXECUTION SERVER 1	CPU	5	–	–	
		MEMORY	5	–	–	
		DISK	5	15	–	
		DATABASE	10	20	–	
		...				
	EXECUTION SERVER 2	CPU	–	5	–	
		MEMORY	–	5	–	
		DISK	–	5	15	
		...				
	EXECUTION SERVER 3	CPU	–	–	10	
		MEMORY	–	–	5	
		DISK	15	20	10	
		DATABASE	15	30	10	
		...				
	RESOURCE 1	DISK	10	–	40	
	RESOURCE 2	DISK		20	40	
	⋮	⋮	⋮	⋮	⋮	⋮

604 605

FIG. 7

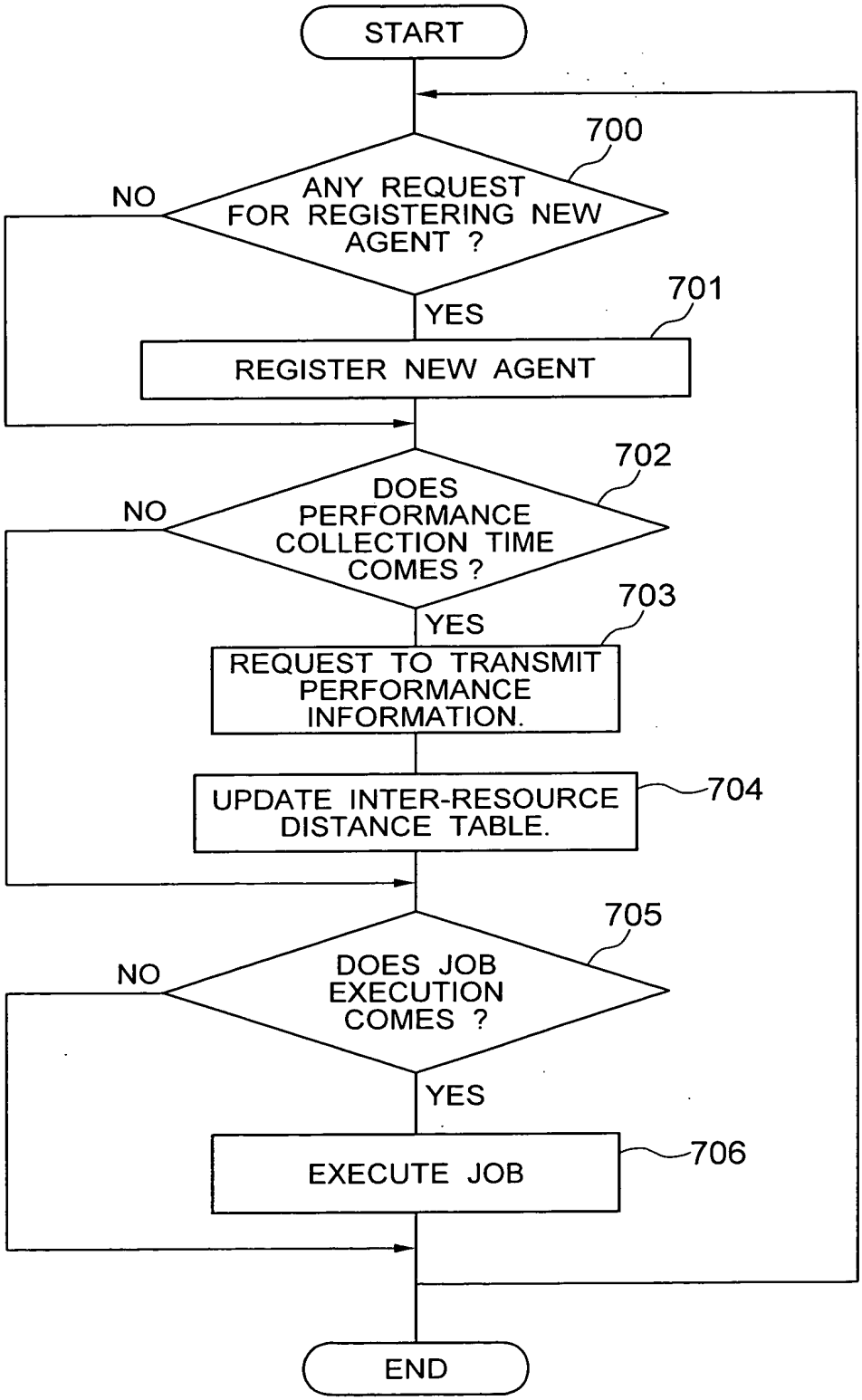
START
700
ANY REQUEST FOR REGISTERING NEW AGENT ?
NO
YES
701
REGISTER NEW AGENT
702
DOES PERFORMANCE COLLECTION TIME COMES ?
NO
YES
703
REQUEST TO TRANSMIT PERFORMANCE INFORMATION.
UPDATE INTER-RESOURCE DISTANCE TABLE.
704
705
DOES JOB EXECUTION COMES ?
NO
YES
EXECUTE JOB
706
END

FIG. 8

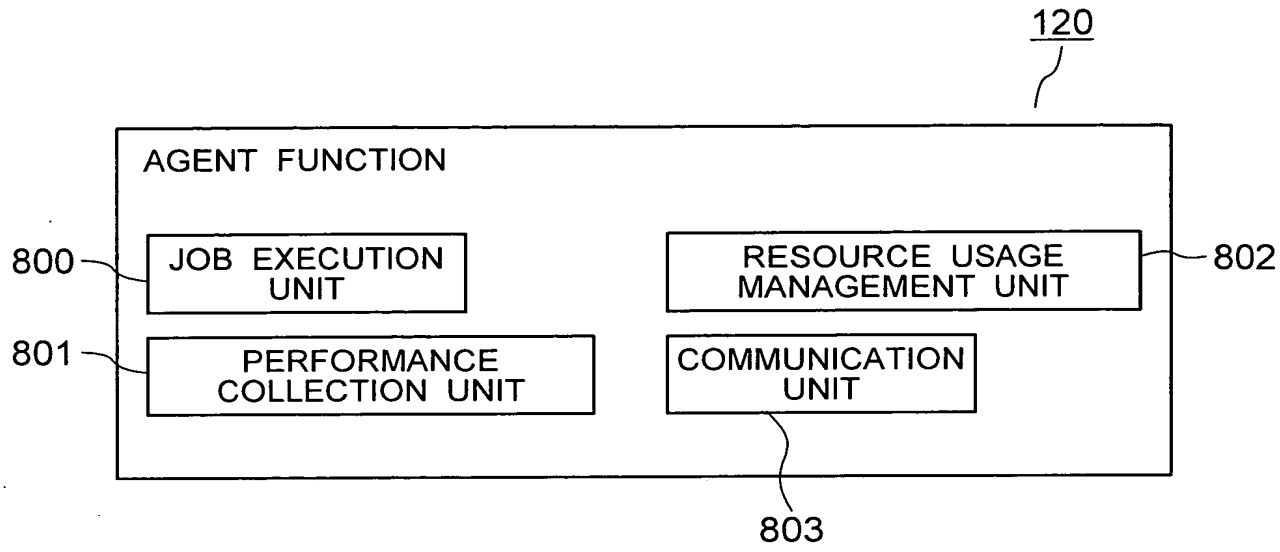
120
AGENT FUNCTION
800
JOB EXECUTION UNIT
RESOURCE USAGE MANAGEMENT UNIT
802
801
PERFORMANCE COLLECTION UNIT
COMMUNICATION UNIT
803

FIG. 9

HISTORY PERFORMANCE TABLE 900

901 COLLECTION TIME	902 COLLECTION ITEM					
	903 CPU USAGE RATE	USING MEMORY AMOUNT	EMPTY DISK AMOUNT	904 AVERAGE DISK PROCESSING TIME	905 AVERAGE QUERY PROCESSING TIME	...
10:00:01	30%	200MB	1000MB	0.5ms	0.01ms	
10:00:02	23%	256MB	900MB	0.2ms	0.02ms	
10:00:03	10%	128MB	900MB	0.6ms	0.05ms	
11:00:00	40%	200MB	500MB	1.2ms	0.25ms	
11:00:01	14%	250MB	700MB	0.3ms	0.10ms	
⋮	⋮	⋮	⋮	⋮	⋮	⋮

FIG. 10

RESOURCE RESTRICTION TABLE 1000

JOB (1001)	THRESHOLD VALUE EXCEEDING TIMES (1003)	THRESHOLD VALUE (1002)			
		CPU USAGE RATE	USING MEMORY AMOUNT	EMPTY DISK CAPACITY	...
JOB 1	2/3 TIME	50% OR MORE	384MB OR MORE	200MB OR LESS	
JOB 2	2/3 TIME	60% OR MORE	–	300MB	
JOB 3	1/1 TIME	80% OR MORE	–	–	
	⋮	⋮	⋮	⋮	⋮

FIG. 11

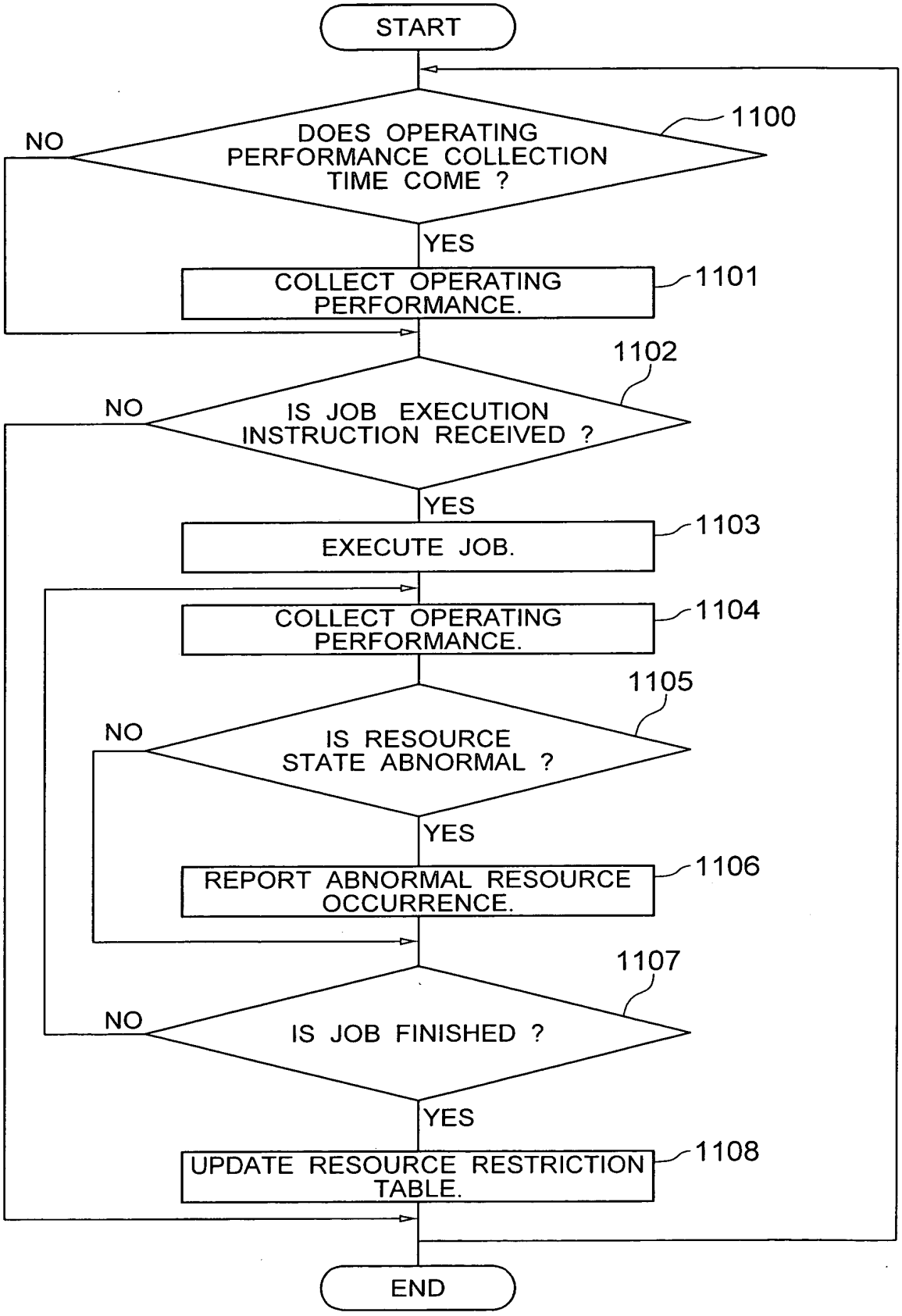
START
DOES OPERATING PERFORMANCE COLLECTION TIME COME ?
1100
NO
YES
COLLECT OPERATING PERFORMANCE.
1101
1102
IS JOB EXECUTION INSTRUCTION RECEIVED ?
NO
YES
EXECUTE JOB.
1103
COLLECT OPERATING PERFORMANCE.
1104
1105
IS RESOURCE STATE ABNORMAL ?
NO
YES
REPORT ABNORMAL RESOURCE OCCURRENCE.
1106
1107
IS JOB FINISHED ?
NO
YES
UPDATE RESOURCE RESTRICTION TABLE.
1108
END

FIG. 12

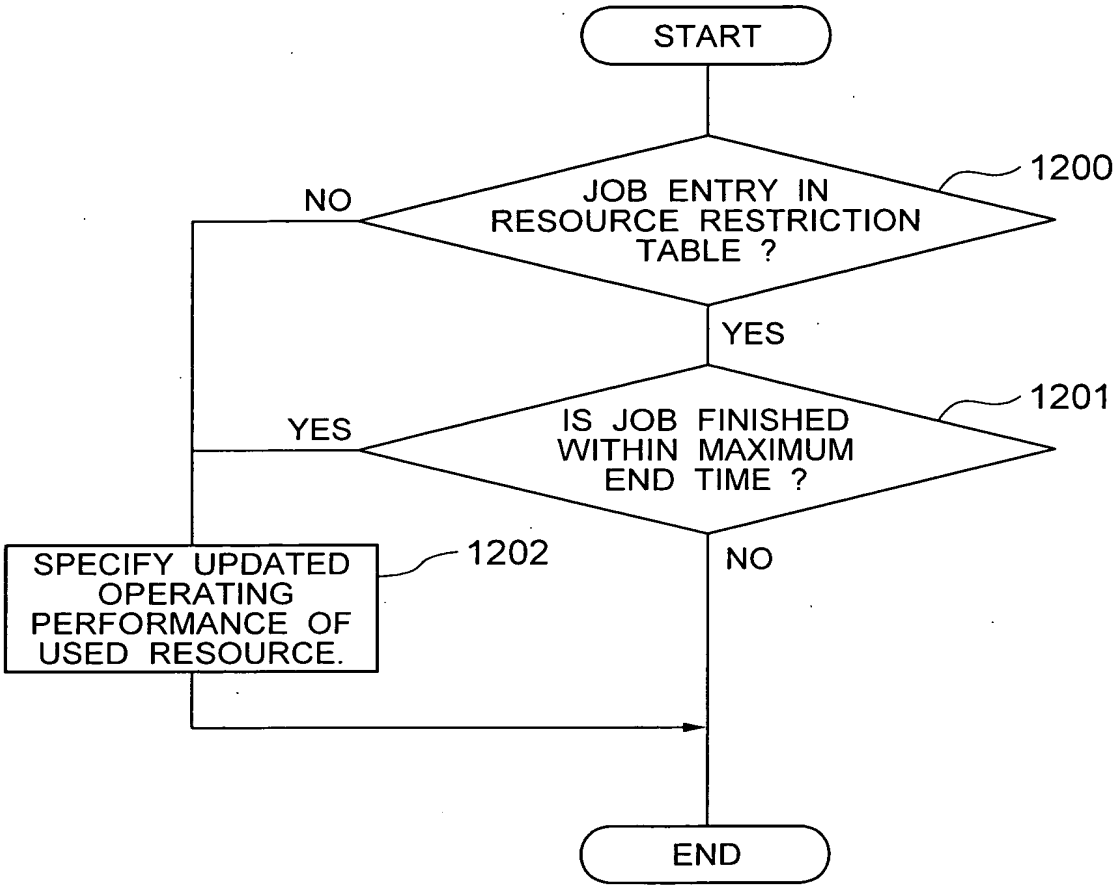
START
JOB ENTRY IN RESOURCE RESTRICTION TABLE ?
1200
NO
YES
IS JOB FINISHED WITHIN MAXIMUM END TIME ?
1201
YES
NO
SPECIFY UPDATED OPERATING PERFORMANCE OF USED RESOURCE.
1202
END

FIG. 13

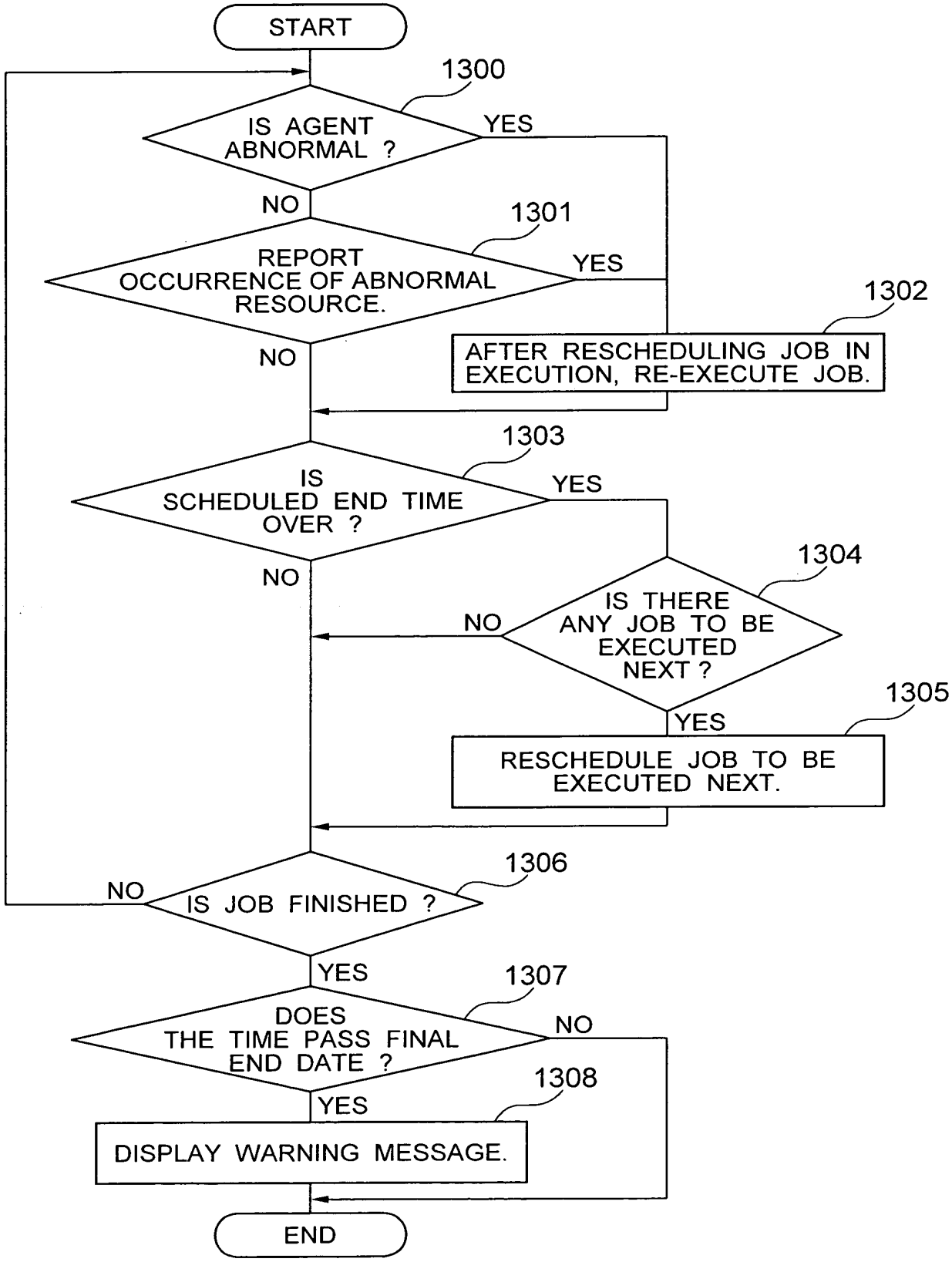
START
1300
IS AGENT ABNORMAL ?
YES
NO
1301
REPORT OCCURRENCE OF ABNORMAL RESOURCE.
YES
NO
1302
AFTER RESCHEDULING JOB IN EXECUTION, RE-EXECUTE JOB.
1303
IS SCHEDULED END TIME OVER ?
YES
NO
1304
IS THERE ANY JOB TO BE EXECUTED NEXT ?
NO
YES
1305
RESCHEDULE JOB TO BE EXECUTED NEXT.
1306
IS JOB FINISHED ?
NO
YES
1307
DOES THE TIME PASS FINAL END DATE ?
NO
YES
1308
DISPLAY WARNING MESSAGE.
END

FIG. 14

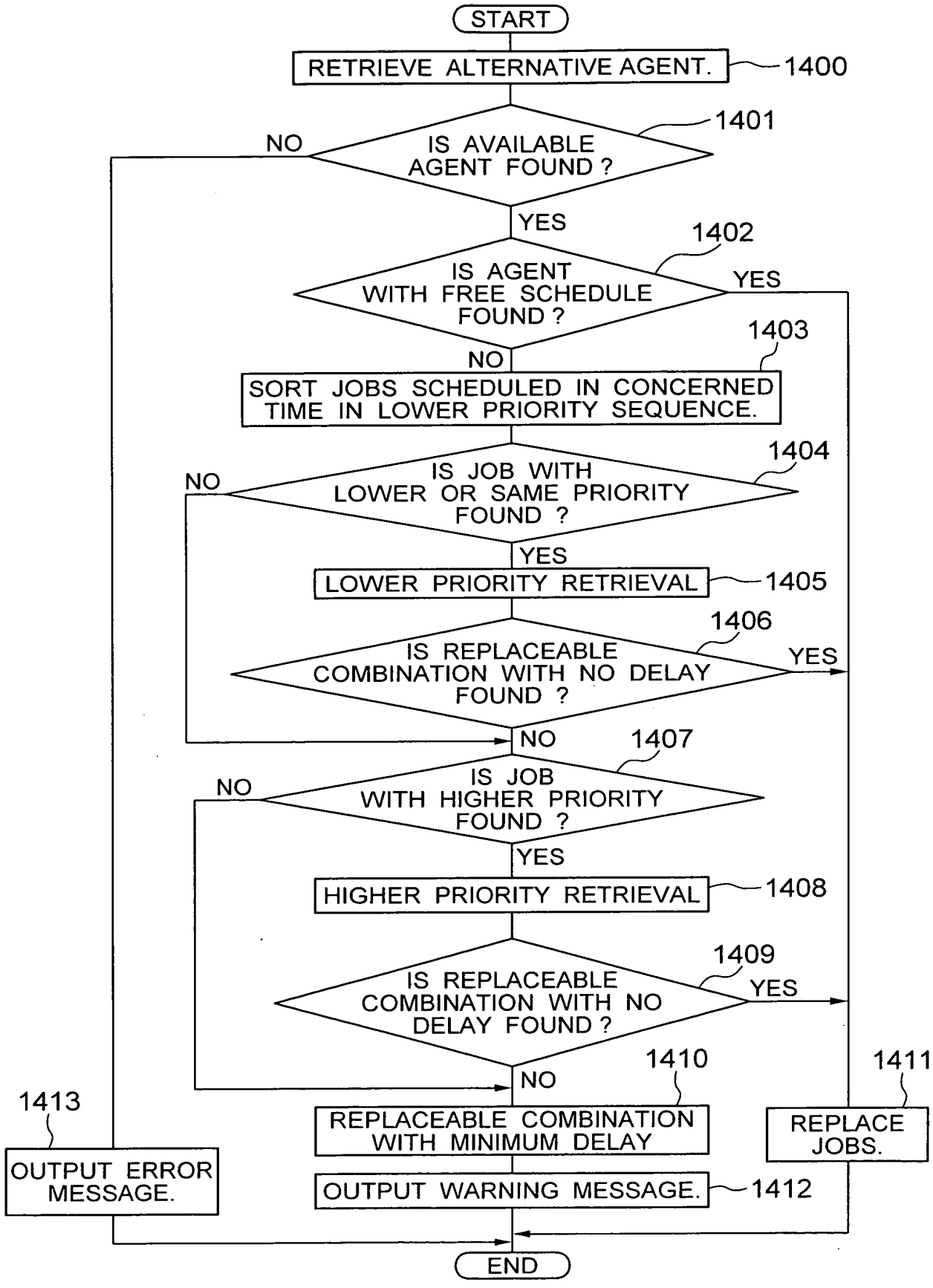
START
RETRIEVE ALTERNATIVE AGENT.
1400
IS AVAILABLE AGENT FOUND ?
1401
NO
YES
IS AGENT WITH FREE SCHEDULE FOUND ?
1402
YES
NO
SORT JOBS SCHEDULED IN CONCERNED TIME IN LOWER PRIORITY SEQUENCE.
1403
IS JOB WITH LOWER OR SAME PRIORITY FOUND ?
1404
NO
YES
LOWER PRIORITY RETRIEVAL
1405
IS REPLACEABLE COMBINATION WITH NO DELAY FOUND ?
1406
YES
NO
IS JOB WITH HIGHER PRIORITY FOUND ?
1407
NO
YES
HIGHER PRIORITY RETRIEVAL
1408
IS REPLACEABLE COMBINATION WITH NO DELAY FOUND ?
1409
YES
NO
REPLACEABLE COMBINATION WITH MINIMUM DELAY
1410
REPLACE JOBS.
1411
OUTPUT ERROR MESSAGE.
1413
OUTPUT WARNING MESSAGE.
1412
END

FIG. 15

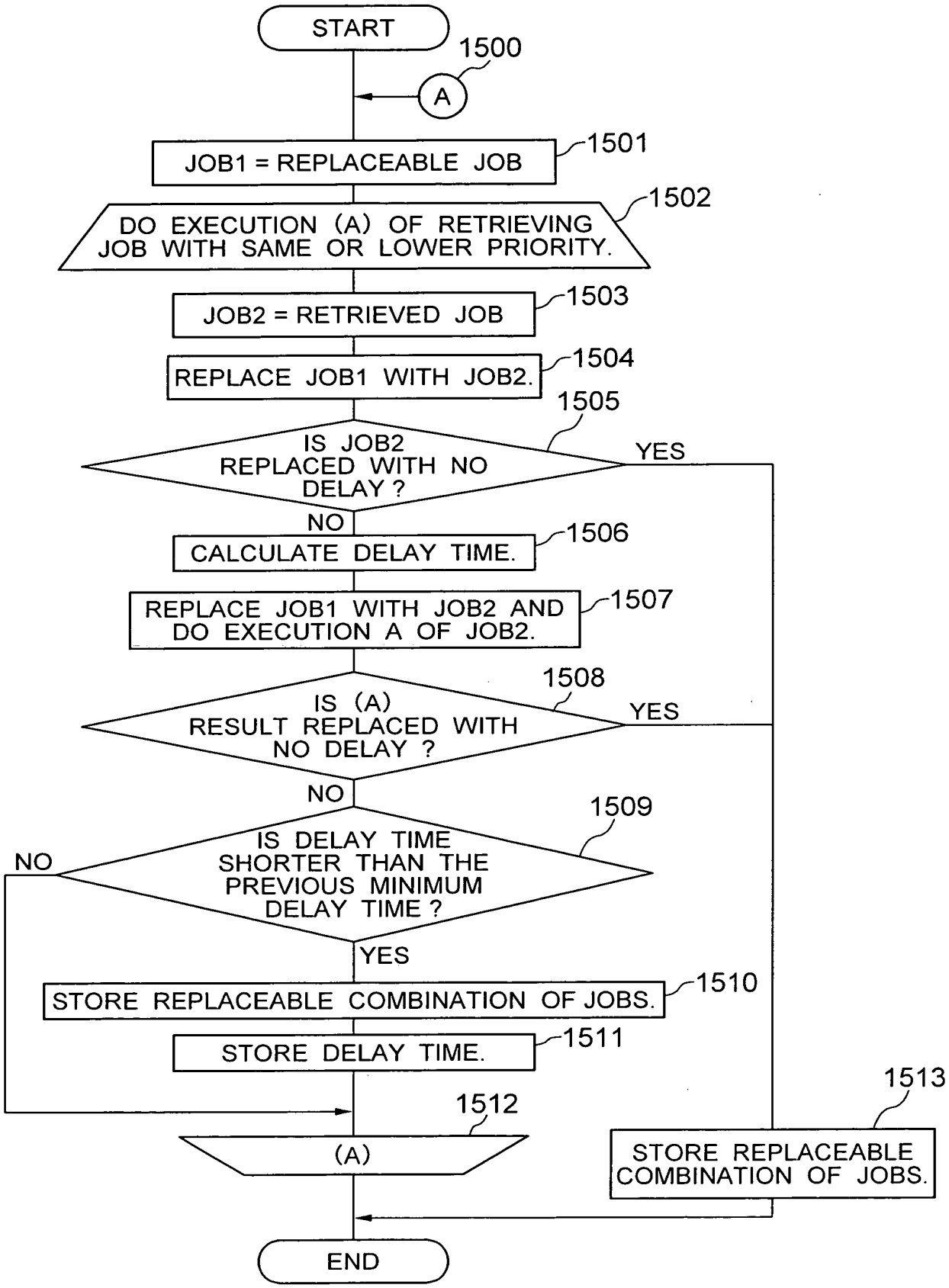
START
1500
A
JOB1 = REPLACEABLE JOB
1501
DO EXECUTION (A) OF RETRIEVING JOB WITH SAME OR LOWER PRIORITY.
1502
JOB2 = RETRIEVED JOB
1503
REPLACE JOB1 WITH JOB2.
1504
IS JOB2 REPLACED WITH NO DELAY ?
1505
YES
NO
CALCULATE DELAY TIME.
1506
REPLACE JOB1 WITH JOB2 AND DO EXECUTION A OF JOB2.
1507
IS (A) RESULT REPLACED WITH NO DELAY ?
1508
YES
NO
IS DELAY TIME SHORTER THAN THE PREVIOUS MINIMUM DELAY TIME ?
1509
NO
YES
STORE REPLACEABLE COMBINATION OF JOBS.
1510
STORE DELAY TIME.
1511
1512
(A)
1513
STORE REPLACEABLE COMBINATION OF JOBS.
END

FIG. 16

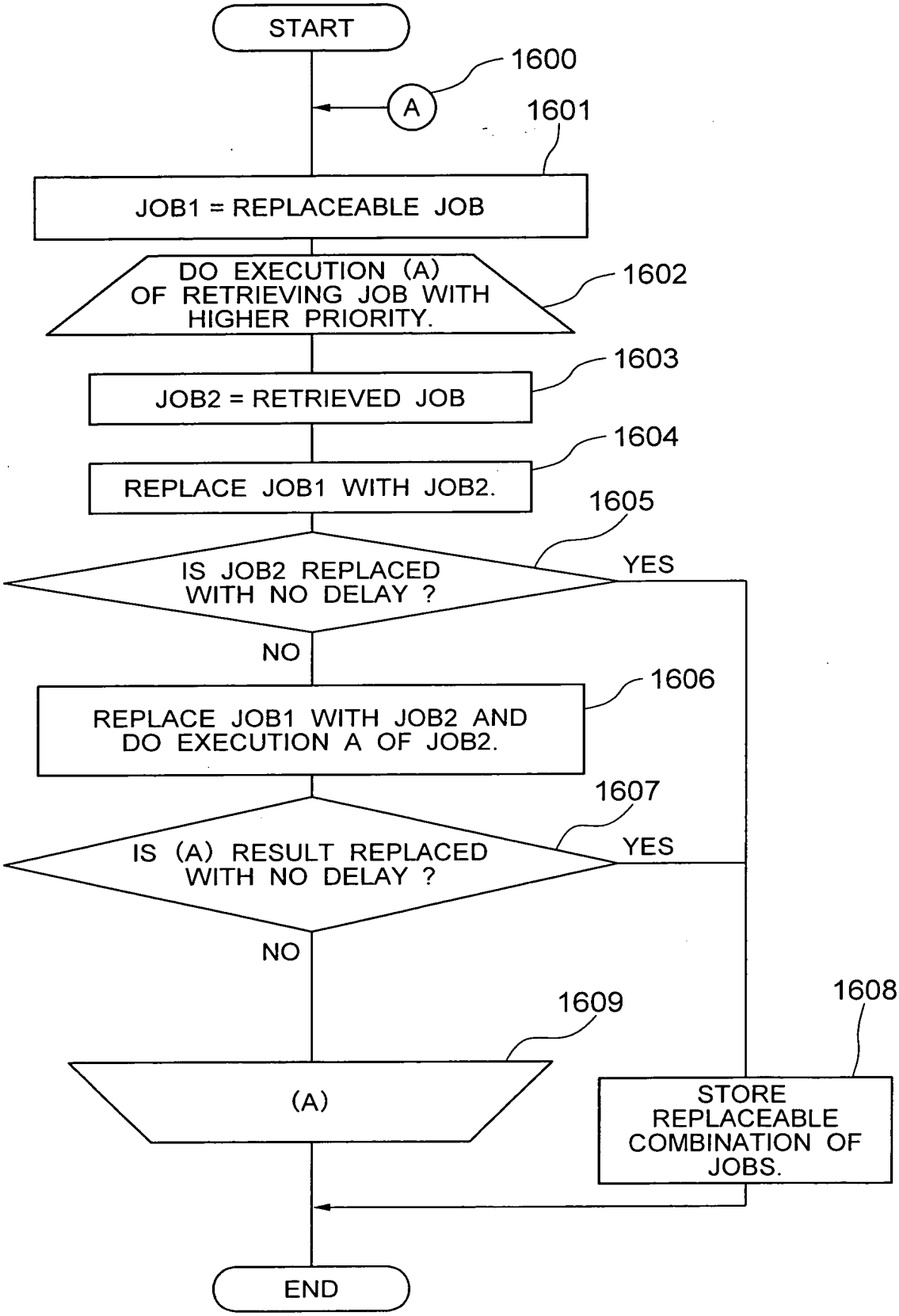
START
1600
A
1601
JOB1 = REPLACEABLE JOB
DO EXECUTION (A) OF RETRIEVING JOB WITH HIGHER PRIORITY.
1602
JOB2 = RETRIEVED JOB
1603
REPLACE JOB1 WITH JOB2.
1604
IS JOB2 REPLACED WITH NO DELAY ?
1605
YES
NO
REPLACE JOB1 WITH JOB2 AND DO EXECUTION A OF JOB2.
1606
IS (A) RESULT REPLACED WITH NO DELAY ?
1607
YES
NO
1609
(A)
1608
STORE REPLACEABLE COMBINATION OF JOBS.
END

FIG. 17

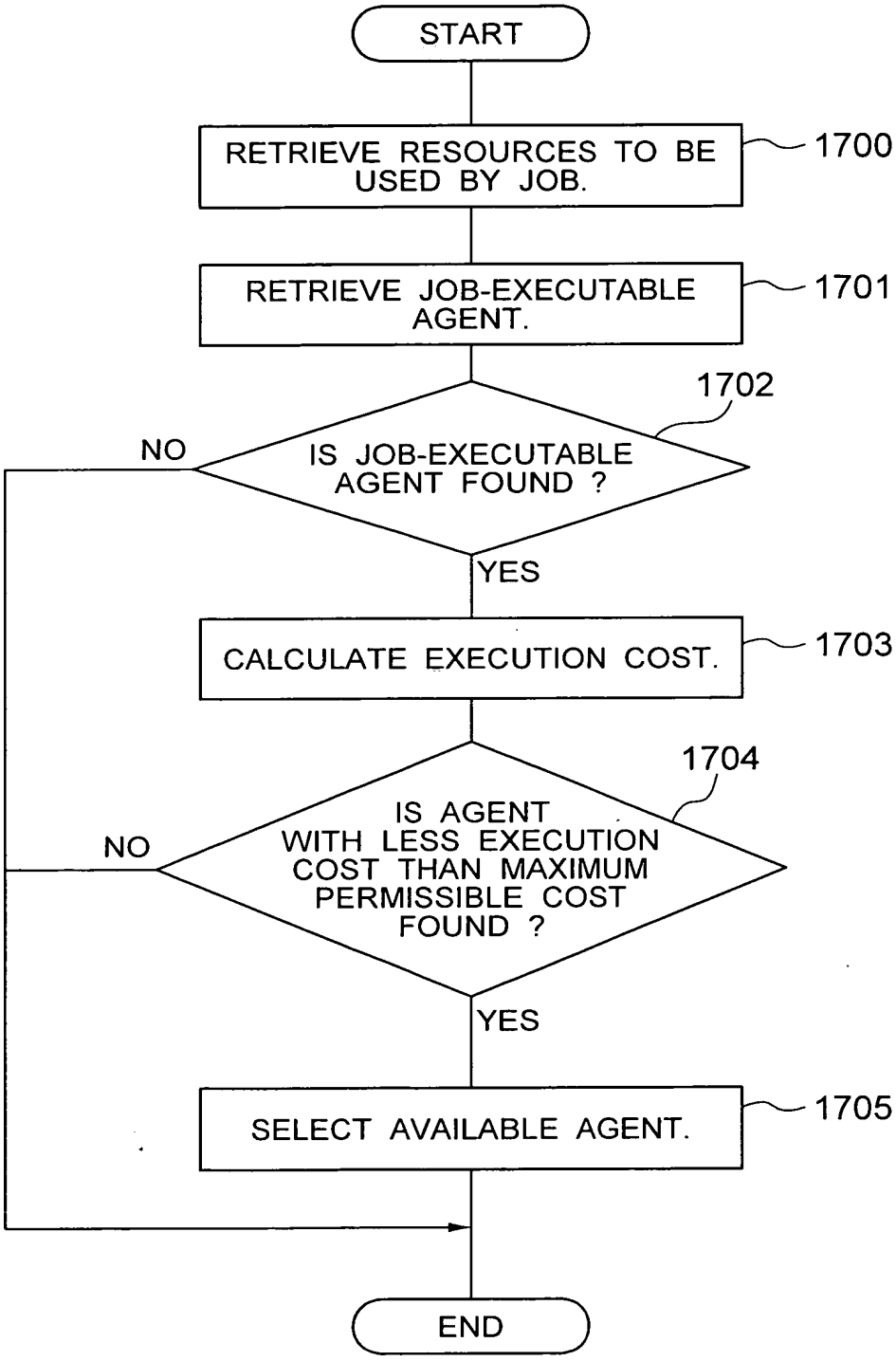
START
RETRIEVE RESOURCES TO BE USED BY JOB.
1700
RETRIEVE JOB-EXECUTABLE AGENT.
1701
1702
IS JOB-EXECUTABLE AGENT FOUND ?
NO
YES
CALCULATE EXECUTION COST.
1703
1704
IS AGENT WITH LESS EXECUTION COST THAN MAXIMUM PERMISSIBLE COST FOUND ?
NO
YES
SELECT AVAILABLE AGENT.
1705
END

FIG. 18A

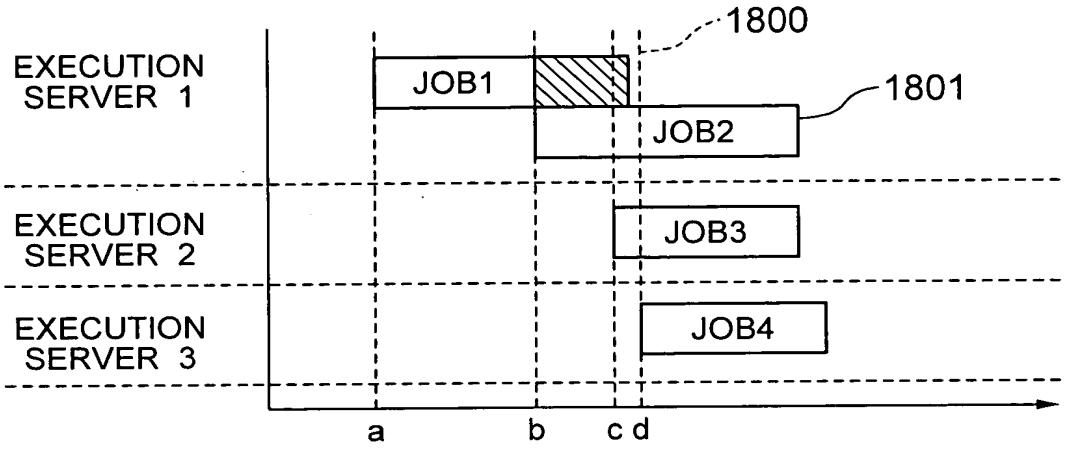

FIG. 18B

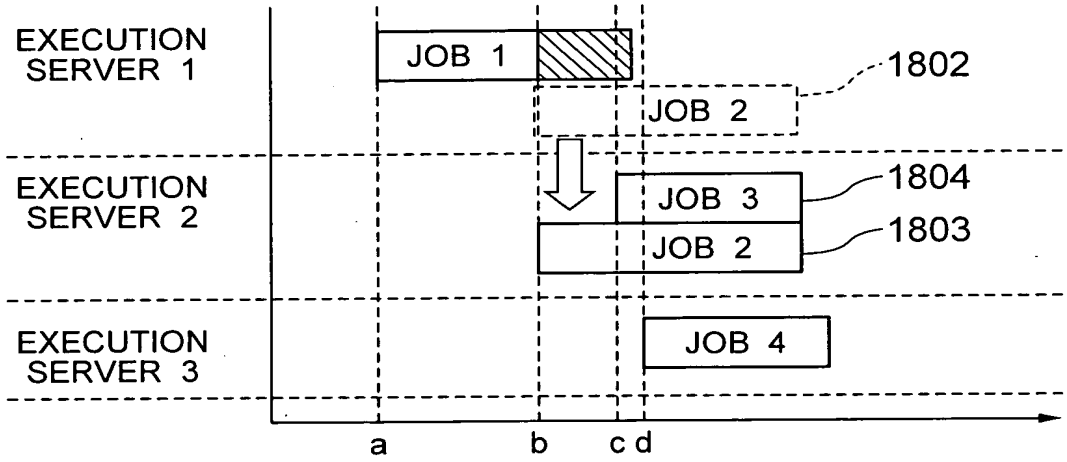

FIG. 18C

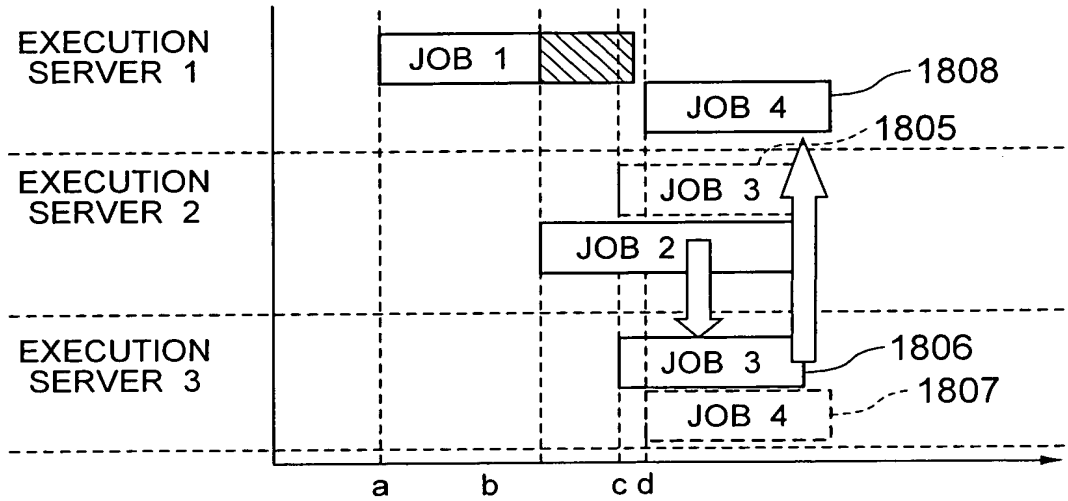

FIG. 19A

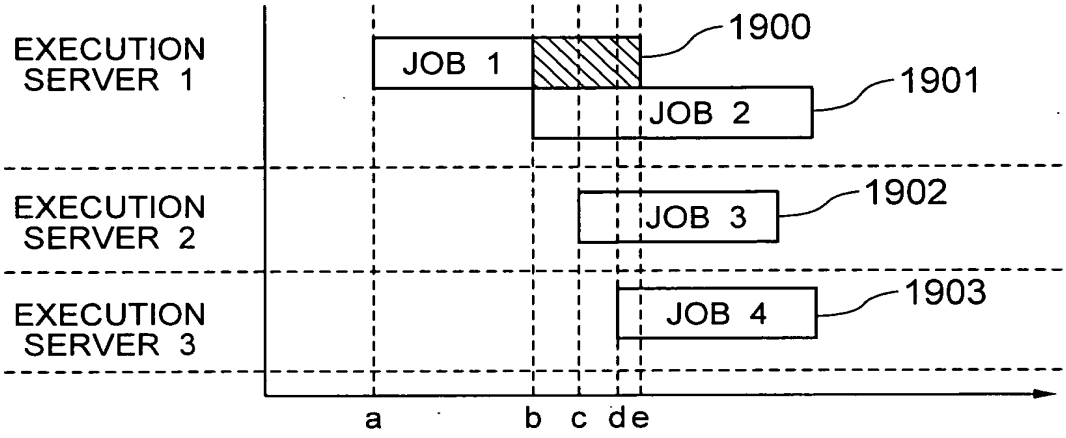

FIG. 19B

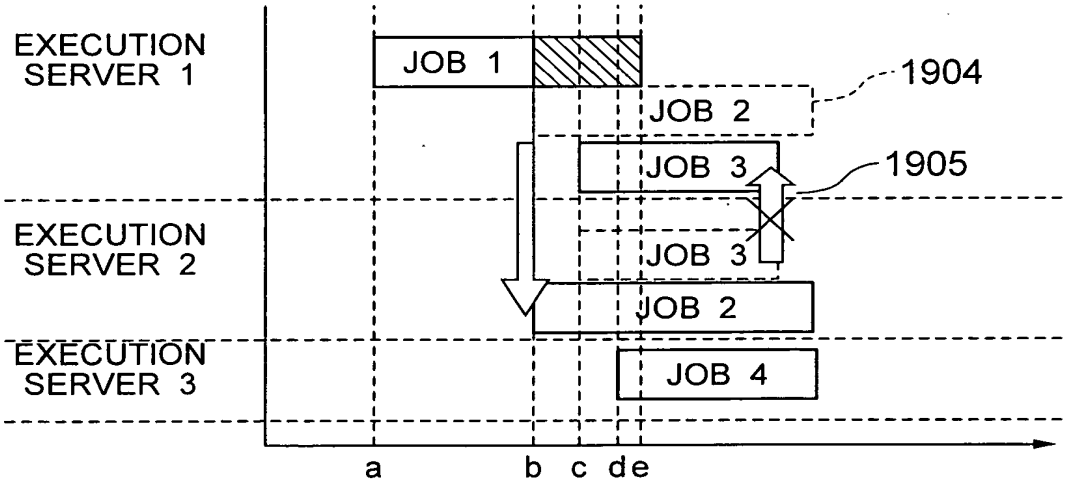
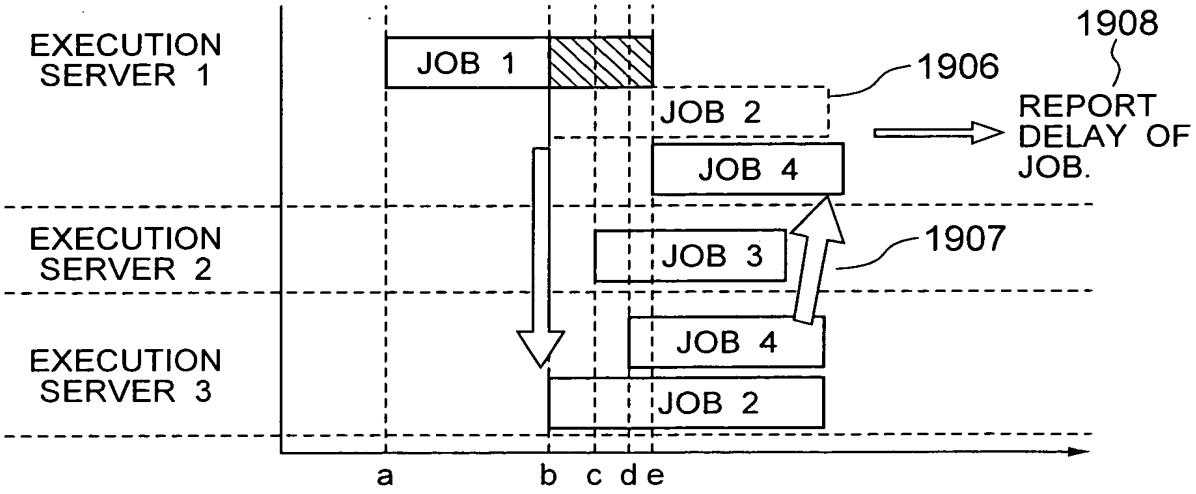
FIG. 19C